NMR Training: Everyone must have a “driver’s license” for a specific instrument to have hands-on access to that instrument. The license is obtained when you successfully complete training for that instrument. There are two “tracks” for NMR training: the Varian track (Gemini-200 → Unity-300 → Inova-600) and the Bruker track (AM-250 → DRX-500 → DRX-600). If you already have experience with Bruker, for example, it will be easiest to start with the Bruker track. Eventually if you use NMR regularly you will want to learn both Bruker and Varian to have the greatest versatility. If you have extensive experience with the Varian Unity or the Bruker DRX you may be able to start with these UNIX-based instruments, but most people start with the Varian Gemini or Bruker AM systems and work their way up to the more modern instruments. NMR training is “practically” free: you only have to pay for the NMR time you use on the instrument during your “driver’s test”. Typically this would be 1½ hours, which currently costs $15.00. This will be charged to your research group.

There are two simple ways to get NMR training: individual training and training workshops. Workshops are scheduled each Spring and Summer as follows:

**Basic NMR Training Workshop: March (during Spring break)**

This covers the Varian Gemini-200 and Bruker AM-250 instruments, with an introduction to how the NMR works (hardware) and how NMR data is processed (hardware). It is assumed that you understand the principle of Fourier-transform (FT) NMR and basic NMR data interpretation, and there is no instruction in NMR theory. The goal is to have a simple understanding of what you are doing when you insert the sample, lock, shim and acquire an NMR spectrum, and how you process the data.

**Advanced NMR Training, Varian Unity-300: mid-June**

The covers the operation of the Varian Unity-300 instrument, with more detailed information on $^{13}\text{C}$ NMR and $^1\text{H}$ decoupling. The various decoupling modes are discussed and examples of fully-coupled spectra (without $^1\text{H}$ decoupling) are given. More advanced 1D experiments are presented, including DEPT (for $^{13}\text{C}$) and NOE difference (for $1\text{H}$). There are two lectures.

**Advanced NMR Training, Bruker DRX-500: late June through mid-July**

The DRX-500 workshop, like Gaul, is divided into three parts. The first week covers the simple data acquisition and processing for $^{13}\text{C}$ and $^1\text{H}$; the second week covers the selective 1D experiments (NOE and TOCSY); and the third week is an introduction to 2D NMR (HSQC, HMBC, COSY, NOESY, ROESY). The modern techniques of shaped pulses and pulsed field gradients are explained as they operate in these experiments.

Each training workshop is a short class which includes lectures, demonstrations and individual training at the instrument. Each participant is given a “practice account” on the instrument(s) covered by the workshop. A bound workshop book covers the lecture material as well as detailed instructions for using the instrument(s). A demo is a group
demonstration on the instrument for four students, lasting 1½ hours. The 1½ hour “driver’s test” involves obtaining a $^1$H and $^{13}$C spectrum of a standard sample, with help from facility personnel. In more advanced workshops this can also include advanced 1D or 2D experiments. A take-home written test covers the parameter names, concepts and hardware of the NMR instrument – the answers can be found in the workshop manual or the workshop transparencies (posted on the facility website). After going over the spectra and written test with Dr. Jacobsen, you get a “permanent” driver’s license. Since the DRX-600 is essentially identical in software and operation to the DRX-500, there are no workshops specific to this instrument. Training for the Varian Inova-600 is tailored to the type of user (Chemistry or Biological) and is given in small groups when needed.

Out of Sequence NMR Training

Outside of the workshop schedule, individual training is available at all times with the understanding that the next available workshop will be attended. The license you obtain is temporary and expires when the next workshop is given. For example, if you get a license to use the Bruker AM-250 by attending a demo outside of the scheduled workshop and completing the “driver’s test”, you will still need to attend the basic NMR training workshop (lecture and written test only) the next time it is given. We need to have at least three participants to give a demo on an instrument, so sometimes you may have to wait until we can organize a demo group.

The Graduate NMR Course (Fall Semester)

A third way to get NMR training is to attend Chemistry 534A (Practical NMR Spectroscopy Laboratory), a 3-credit graduate laboratory course. This course is given in the Fall semester of each even-numbered year (e.g., 2008) and covers all of the common 1D and 2D experiments used for elucidation of structure in solution. Upon successful completion of this course you will have a license for hands-on operation of the Varian Unity-300, DRX-500, DRX-600 and Inova-600 instruments. Chemistry 534B, which is taught in the Fall semester of odd-numbered years, is a 3-credit lecture course covering NMR theory. Chem 534B does not include hands-on NMR training.